SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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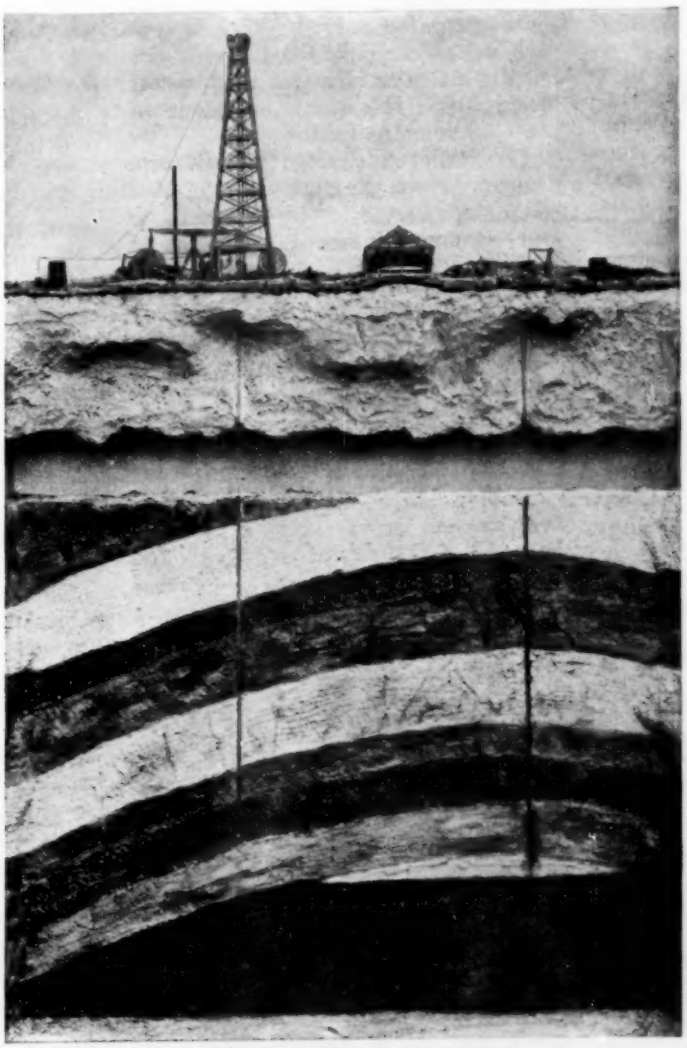

THE BIRTHPLACE OF OIL

Museum Model Shows What's Under an Oil-Field

(See page 206)

Vol. XV No. 417

Submarine Valley and Ridge Discovered

Oceanography

A submarine "deep", or valley, extending down a mile and three quarters below the level of the surrounding ocean bottom, and a submarine ridge extending upwards nearly two miles, are the latest discoveries of the non-magnetic ship *Carnegie*. The vessel is now cruising in the south Pacific, under the command of Capt. J. P. Ault. On March 13, she arrived at Papeete, Tahiti, after a cruise from Callao, Peru. She left Papeete on March 20, bound for Apia, Western Samoa, where she was expected at the end of the month.

The deep was discovered on February 16 with the sonic depth finder, Dr. John A. Fleming, acting director of the Department of Terrestrial Magnetism of the Carnegie Institution and owners of the vessel, announced to Science Service. Within a distance of 50 miles the depth of the ocean changed from 2,700 meters to 5,400 meters and back to 4,100 meters, the drop being about a mile and three quarters, and the greatest depth being about three and a third miles. Capt. Ault named the depression the Bauer deep, after Dr. Louis A. Bauer, director and organizer of the Department of Terrestrial Magnetism.

The submarine ridge was discovered on the voyage from Easter Island to Callao, northeast of the island of San Felix, which is off the west coast of Chile. Its position is approximately 80 degrees west longitude and 23 degrees south latitude. It extends about three thousand meters, or nearly two miles, above the surrounding ocean floor, and is a continuation of the ridge that forms the San Felix islands. It has been named the Merriam ridge, after Dr. John C. Merriam, president of the Carnegie Institution.

Two other uncharted ridges were discovered on the last voyage, and steep slopes were found off Tatakoto and Amanu Islands. A sample of material from the ocean bottom in this region showed a few fragments of black lava with no trace of ooze, indicating recent volcanic origin.

The work done on this passage included: 63 determinations of magnetic declination and 17 of magnetic intensity and inclination; 17 ocean-stations at 15 of which bottom-samples were obtained; 206 soundings; 35 pilot-balloon flights, one of which was followed to a height of over 6 miles; 9 determinations of evaporation; 4 series of atmospheric-electric observations by eye-readings, each throughout 24 hours; and 23 complete 24 hour photographic electrograms of potential gradient.

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Where Oil Comes from

Geology

A model of an oil field, showing how an oil well is drilled, how one already bored is pumped, and how the various strata of the earth between the surface and the oil deposit thousands of feet below are arranged, has just been placed on exhibition in the department of geology at Field Museum of Natural History, and is shown on our cover.

The model represents part of the oil field at Lawrenceville, Illinois. To insure accuracy in every detail, Henry W. Nichols, associate curator of geology, who supervised the construction of the model, went to Lawrenceville and made field studies and notes before the model was built.

The model shows the subterranean strata in which the oil was made by nature during thousands of years through the decomposition of fossils, and still lower the oilsands where the oil floats on salt water along a fold of the rock shaped like an inverted trough. Also represented is the space above the oil surface, filled with natural gas.

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African elephants show a tendency to what might be called "right-handedness," since their right tusks are usually worn down by digging more than the left.

Switzerland has one bicycle to every five inhabitants.

The Naskapi Indians of Labrador wear wooden goggles to protect their eyes from the glare of the snow.

In This Issue—

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Universe Dying Unless Matter Created

Astronomy

Creation of matter in some outlying part of the universe, by some process of which we have no inkling, is necessary or else the universe will return to the condition described in Genesis, "without form, and void."

This is the opinion of Dr. Walter S. Adams, director of the Mt. Wilson Observatory of the Carnegie Institution of Washington.

It is based on modern conceptions of the source of energy in stars, which suppose that their matter is being transformed to energy. Eventually, unless some such process exists, all the matter in the universe would be transformed.

Ordinary sources of energy are entirely inadequate for the stars, said Dr. Adams. Transmutation of elements, in which the electrons and nuclei of the atoms are redistributed into forms involving less energy, is one possible method.

"If, in this process, several atoms of the simplest of all elements, hydrogen, were to be combined to form one atom of a more complex element, about 0.008 of the mass of each atom would be lost in the change and would be released in the form of energy," said Dr. Adams.

"For example, were a pound of hydrogen transformed into helium, an atom which is made up of four hydrogen atoms, the result would be 0.992 pound of helium and 0.008 pound of energy. This last figure sounds very small, but 0.008 pound of energy is rather more than 430 billion horse-power a second.

"So if we can think of the sun as originally a mass of hydrogen gas which has gradually been transformed into the various elements that we now find within it, the energy released in the process would keep the sun shining for about 10 billion years. The time-scale provided for in this way seems to be ample even for the vast periods required by cosmological history.

"A second conceivable way by which energy is supplied in the stars is that which would take place if matter were being annihilated. If instead of concluding that a part of the atomic energy is released by the transmutation of elements, we assume that all of it may be made available by the complete annihilation of matter, our supply of energy would become very much greater.

"In this case our pound of hydrogen would give us a pound of energy instead of 0.008 pound, and our total supply would be multiplied by a factor of 125. Our sun, on this hypothesis, would be radiating away its mass at the rate of 120 thousand billion tons a year and the material now contained in it would be sufficient to maintain the present rate for about 15 thousand billion years longer. At the end of that time, however, no mass would be left.

"One final consideration of profound interest is that of the possible reversibility of the process of radiation. If matter can be annihilated to produce energy, can energy recombine, as it were, to form matter?

"Of the energy poured out by the sun less than one (*Turn to next page*)

Aztec Treasures From Mexican Pyramid

Anthropology

By Emma Reh Stevenson

Earthenware pots containing charred human bones, together with ornaments of gold, obsidian, and polished stone, and dozens of fine obsidian arrow heads and knives, have just been unearthed on the west or main side of the Aztec pyramid at Tenayuca, near Mexico City.

The pyramid proper has been completely excavated by the Mexican Direction of Archæology and restoration has been carried as far as knowledge permits, but in clearing the platform at the foot of the west pyramid face where great double stairways ascend the structure, three additional steps were discovered leading down to a still lower level. It was in the earth at the bottom of these new stairs that the funeral pots were found.

They are three in number. The first is of plain red ware, about nine inches in height and diameter with a handle half way down on each side. The second is of the same shape and style, but has ornate black line drawings on its upper half.

The third is the most interesting of all, for it is in the shape of a grinning pot-bellied beast sitting on its haunches, which the Indians of Tenayuca recognize as a female fox. Her cheerful grin shows all the side teeth, and from the front protude two fangs, between which hangs the tongue. There is a look of perverted glee on her face as if she were highly pleased with the funereal contents of her distended stomach. The opening of the vessel is in the top of the animal's head, which has been broken off.

Each of the jars contains its mass of human bones, ashes, charcoal, and a variety of articles which were probably the precious possessions of the personage within during his lifetime. One of the jars contains wads of half-burned cloth, black from carbon but preserved for centuries by the surrounding ashes. Such finds of genuine pre-Columbian fabrics are rare. The material is quite finely woven of well-twisted thread, two threads being interwoven one way of the goods by a single thread the other way, making an attractive weave. The nature of the fiber is not known.

In the burned mass in the jars, nine articles of gold were found. The largest is in the form of a flat fluted shell, and another comparatively large bit is fused out of shape. There is a piece of chain made of gold-wire circlets about a quarter of an inch in diameter. Another similar length of chain has been fused by the heat of cremation. There are two earring-like ornaments of stone suspended from similar gold ringlets. There are several other metal objects, apparently copper.

Some of the ornaments, which perhaps once formed a necklace, are of polished obsidian or volcanic glass. One of these, pierced like a bead, is perfectly made in the form of a miniature pumpkin, and is beautifully polished. A small stone plaque, perforated for suspension, is grooved in the image of what is perhaps a goddess.

The dead men in the jugs were buried with a large number of obsidian arrow heads. Many of these had points as sharp as needles. There is also a good supply of obsidian knives or razors. Other treasures in the jars (*Turn to next page*)

Universe Dying?—*Cont'd*

two-hundred-millionth part is intercepted by the planets, and a quite negligible amount by the stars, while the flood of radiation from the stars themselves passes out into remote space quite unchecked except for the small quantities absorbed by the nebulae.

"Is it possible that radiation is finally reflected back from the boundaries of a limited space, or do we have in the nebulae some mechanism by which the energy released from matter can be stored up once more in the form of atoms and electrons?

"Such considerations are purely speculative, for we know of no process of this kind. If it does exist, we can picture our physical universe as renewing itself and perpetually changing; if it does not exist and energy is finally dissipated, the end will be that pictured in the first chapter of Genesis: 'And the earth was without form, and void; and darkness was upon the face of the deep'."

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A young gorilla is a more solemn animal than the frisky chimpanzee.

Rabbit farming has become an important industry in the Southwest.

Possible admission of airplanes in National Parks is being considered.

Aztec Treasures—*Cont'd*

include a half-calcined seashell, some broken pottery pieces, and a small finely made three-legged dish, covered inside and out with carefully applied drawings in black lines. The dish may have been an incense burner.

The pyramid of Tenayuca, so near Mexico City where most of the Aztec relics were very thoroughly destroyed by the Conquistadores, is an exception in its line, for it has yielded very important materials during the last two years. Today it is the most complete Aztec site known, wth details of architecture and decoration that have not survived elsewhere. Excavation and restoration here have been conducted by the Mexican government, under the direction of José Reygadas Vértiz.

The pyramid is mentioned by Bernal Diaz, one of Cortes' soldiers, who described the famous serpent border for which the pyramid is now known. By being covered with earth soon after the Conquest, rare details have been preserved.

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"Modern" Insects Prefer Bright Lights

Ecology

By Frank Thone

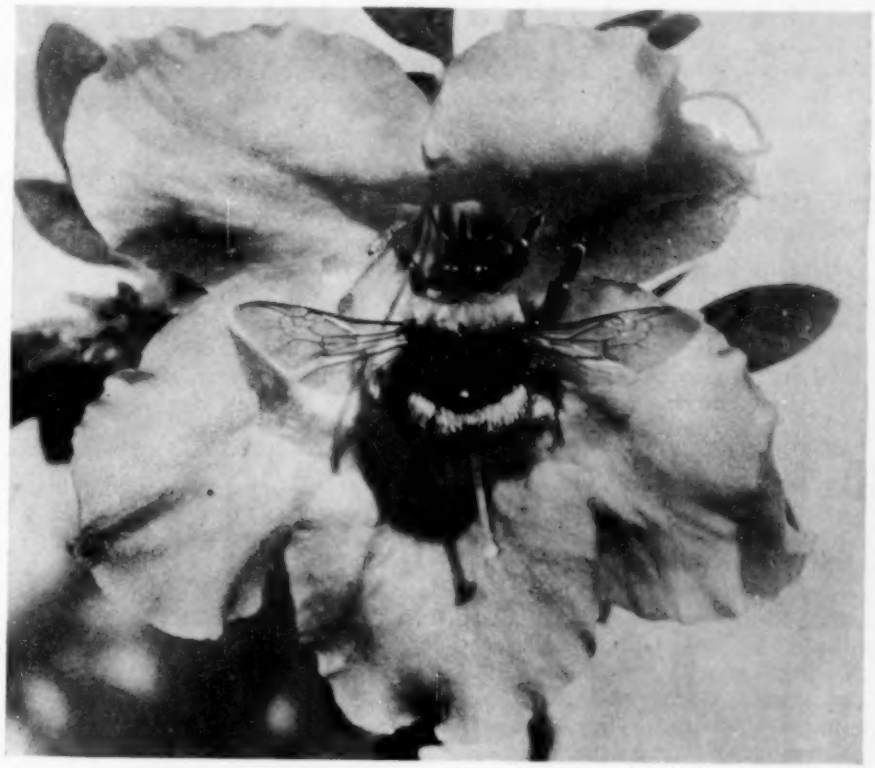
Bright lights, life tuned up to jazz tempo, a hot time being had by all—such is the road to racial damnation, according to all the prophets from Jeremiah down to Anthony Comstock. The prophets may be right so far as human-kind is concerned, but in the paradoxical world of the insects that swarm in the heavens above, in the earth beneath and even in the waters that are under the earth, the dictum is reversed. Bright light, high temperature and a fast rate of life processes are the things that the most advanced and up-to-date hexapod citizens thrive on, beating their slower, more cool-blooded neighbors in the evolutionary race.

Such at least is the thesis set forth by Prof. Clarence H. Kennedy of Ohio State University, in a communication to the official journal of the Ecological Society of America. And other naturalists, looking over his opinions, declare that his generalization holds, in a broad way, for many other forms of life besides the insects. Prof. Kennedy seems to have hit upon a scientific principle that will do a great deal toward unravelling many tangled questions about the distribution and evolution of animals and plants.

"Metabolism" is the key word in Prof. Kennedy's theory. Metabolism is one of those scientific terms that is just now graduating from the technical vocabulary of the specialist into common English, as calories and vitamins did a short time ago. Lots of people talk about metabolism now, and in a few years we'll all be using it without batting an eye.

Metabolism is simply a shorthand word meaning the process of turning the food we eat and the air we breathe into the energy of muscular work and mental activity and bodily warmth. It means, in brief, the whole give-and-take of energy that goes on inside us. It is one of those useful "steamer-trunk" words, that doesn't take up much room but can have a lot packed into it.

Well, then, according to Prof. Kennedy the up-and-coming insects, the ones that have got along farthest and fastest in the evolutionary course of things, are the ones with the highest rates of metabolism. The most advanced, most "modern" insects have the fastest physiological processes, turn food into energy most rapidly, grow from helpless infant grubhood to maturity in the least time. An advanced insect like a bee may live its whole life in less than a month, and some of the more highly evolved flies can complete a life-cycle, from egg to egg-laying adult, in as little as ten days. In contrast with such insects as these are creatures like the Mayflies, which require a whole year to come to maturity, June-beetles, which take two or three, and as an extreme case the seventeen-year cicada, which lives underground for more than half a human generation before it emerges for its brief day in the upper air.



BEES AND THEIR RELATIVES, fast, energetic, lovers of the bright sun, rate as "moderns" among insects

The short-lived, quick-breeding insects in general have high metabolism rates; the long-lived, slow-breeding ones low metabolism rates.

Not only length of life-cycles but rate of movement will help us to judge the evolutional position of an insect. It might be stated as a jingle: the lower the slower. Of relatively primitive rank, Prof. Kennedy says, are "usually stupid insects, which, except spasmodically when excited, are very slow in their movements. Contrasted to these are the higher flies, the butterflies, the ants, bees and wasps which are as a rule very active insects, many of which are on the wing for long hours day after day."

Insects are cold-blooded animals, and are therefore directly dependent on the warmth of the sun for their body temperature. They differ in this from man and the warm-blooded animals, which can keep up their body heat by burning part of their food-fuel and are therefore able to keep awake and going even during freezing weather. No matter how energetic an insect naturally is nor how high its normal metabolism rate, it can not continue its life-processes when the air around it is cold.

"Modern" insects like a warm environment, because that is what enables them to live at the high rate set by their natural metabolic processes. Primitive ones do not like to have it too warm, because higher temperatures make physiological demands on them which their lower metabolism is not prepared to meet. The result of (*Turn to page* 211)

Modern Insects Like Bright Lights—*Continued*

this contrast, according to the Ohio entomologist, is a sorting of the highly evolved from the more primitive insects along three general lines. Taking the world as a whole, he says, the "modern" insects prefer the tropics, while the primitive keep to the cooler temperate zones and even to the arctic. They also inhabit the upper levels in mountainous regions.

As a champion example of the slow, old-fashioned insect that likes it cold, Prof. Kennedy points to *Grylloblatta*. This creature is a sort of missing link between crickets and cockroaches, two relatives in a primitive order of insects that was represented on earth scores of millions of years ago, when the coal beds were being formed. It is neither cricket nor cockroach, but has some of the characters of each. Its name expresses its nature, for it is a compound of *Gryllus,* which is the Latin name for cricket, and *Blatta,* which is what entomologists say when they want to be polite about the cockroach. *Grylloblatta* is found only in cool, northerly regions, or well up in the mountains, and in nature requires three growing seasons of four months each to go from egg to adult. When reared in captivity it has to be kept on ice in a refrigerator.

Prof. Kennedy's own specialty has been dragonflies and their kin. These are in general a primitive order of insects, but they show a wide range of difference in degrees of evolution. Prof. Kennedy drew up a list of all the dragonfly species on which he could get distribution data. He found that the more highly specialized ones were to be found in the tropics, and that from the equator the distribution curves sloped downward toward the north and south, terminating finally in the least highly specialized dragonflies in the coolest regions. Other insects studied in lesser detail showed the same tendency.

A second way in which the more advanced insects show their preference for heat is in their choice of seasons. In the temperate zones, where the insect breeding season warms up at first slowly and then more rapidly in the spring, to a high point after midsummer, and then shows a temperature decline until frost time, the appearance of the insects can almost be plotted on the curve of daily temperatures. The primitive, coolness-loving insects come first—such things as Mayflies, stoneflies, caddisflies and many of

GRYLLOBLATTA, the insect that has to be raised in a refrigerator—one of the "slowest" and least modern of hexapods

the beetles. Then, as the season advances and the days become longer and warmer, the livelier, more highly organized insects put in their appearance, until in late July and August we have the heyday of the butterflies, wasps and dragonflies. Here also belong the many species of flies—for little though we may like them, flies are highly evolved insects and from their own point of view great successes in the world.

Finally, this temperature preference among insects sorts them out according to the places where you will find them at any given time, and according to the hours when they are abroad on any given day. The more advanced, warmth-loving, high-metabolism insects prefer the bright light of day, and may most commonly be found flying in open places, especially around midday. The more primitive, low-metabolism species that prefer to keep cool are to be sought in the shady woods, or creeping beneath stones and logs. Those that venture into the open at all avoid the hot part of the day, and come forth in the morning or evening dusk, or even as nocturnal fliers, when it is quite dark.

For specific examples we may look for a moment at one or two orders of insects. One group includes the flies and their relatives. The flies themselves, as already noted, are relatively advanced insects. They click into Prof. Kennedy's scheme very nicely, arriving in full numbers when the season is well advanced, breeding rapidly, flying fast and showing a decided preference for open, sunny, warm places. Their less advanced relatives, the mosquitoes, are never in sight when the flies are, but hide in the woods or under shrubbery by day and fare forth to make us miserable by night. They breed rapidly also, but it may be noted that whereas flies lay their eggs in the fetid heat of decaying offal, mosquitoes breed in water, which is of course always more or less cool. The twilight-loving gnats occupy an intermediate position between flies and mosquitoes.

Another order that affords interesting examples is the group that includes grasshoppers and their kin. The grasshoppers themselves are among the most advanced members of this order, and they are found prevailingly in open grasslands—pastures, fields, prairies—singing their shrill happiest when the day is bright and hot. If you search in the cool woodland ravines nearby you will find few grasshoppers, but creeping among the damp dead leaves under foot there will be numbers of their more primitive kin-insects; grouse-locusts, and the cleanly wood-roaches, cousins of the disreputable immigrant swarms whose liking for the dampness and dark of cellars and plumbing-cracks drives the housewife distracted. And when night comes on, another more or less primitive section of the grasshopper clan joins in the chorus: the dark crickets of the ground, the snowy crickets of the tree-tops and the interminably arguing katydids.

Examples like this might be piled one on another, but these serve to illustrate Prof. Kennedy's point. Other scientists, surveying their own special fields, have stated that the principle seems to hold for other things besides insects. Dr. H. E. Ewing of the U. S. National Museum, whose specialty is the study of the primitive (*Turn to next page*)

Modern Insects Like Bright Lights—*Continued*

groups of creatures that stand below the insects on the evolutionary scale, says that the principle of "distribution by temperature preferences" holds good in his field also.

"The most widely distributed animals in the world are not human beings, as we sometimes think," Dr. Ewing said. "They are mites, primitive tiny eight-legged things lower in the scale than spiders. Species of mites, together with spring-tails, which are exceedingly primitive insects, make up more than 90 per cent. of the known fauna of the desolate continent of Antarctica, and these creatures are also found on the highest, coldest slopes of glacier-bearing mountains.

"Not long ago, up in the mountains of the Pacific Northwest, I found a strange creature related to the mites and spiders, but even more primitive. It seems to be a 'surviving ancestor' of the daddy-long-legs or harvestman; only its legs are short. The land where this cold-loving animal was found is geologically very ancient. Though it is now a part of the American continent, it was once a great island, most of which has now sunk under the ocean, and many of its animal inhabitants seem to be immigrants that came from the Asiatic side a very long time ago."

Probably the greatest difficulty in the application of the theory will be met when it comes to the warm-blooded animals. These are all high-metabolism organisms, but because they have learned the trick of keeping themselves warm by burning part of their food as fuel, and have also found out how to protect themselves inside of coverings of clothes, fur or feathers, they are not so directly dependent on the temperature of the surrounding air as their cold-blooded brethren. There are indications, however, that even here the rule will apply at least in a broad way.

Among the cold-blooded vertebrates the marine fishes, free to rove the seven seas, may also be difficult to marshall under the flag of the new theory. But even among these, it is worth while noting the strange, butterfly-bright, highly specialized, "modern" inhabitants of the warm waters over the coral reefs of the tropics, as contrasted with the more conservative codfish and herring and mackerel of northern seas.

The members of the plant kingdom seem to fall into line fairly well. The jungles of the tropics are the home of some of the most highly evolved forms of plant life, while the conifer forests, with trimmings of the primitive willows, poplars, birches and alders, rule the arctic and subarctic belts. When Kipling wrote of Britain's "dominion over palm and pine" he was only anticipating, as poets often do, a generalization of science.

And just as the more primitive insects appear predominantly in the cool spring and the more advanced ones in the hot summer, so do our spring woods show forth simple flowers and our summer pastures the more complicated ones. Bloodroot, trillium, trailing arbutus, Solomon's seal, Jack-in-the-pulpit, and earliest and lowliest of all, skunk cabbage, are flowers much farther down in the evolutionary scale than the summer-blooming goldenrod, sunflower, Indian paintbrush, toadflax and horsemint. And it may be noted also that the flowers of the cool spring are flowers of the woods, while those that come in the height of summer are much more given to sunning themselves in open fields and meadows and along treeless roadsides.

Prof. Kennedy's theory is as yet only in its preliminary form. Both he and other scientists are busy scanning their lists of wild-life acquaintances to see how well it will hold, and where and how much it will need to be modified. But as a bold, broad generalization, into which the larger facts of the natural world seem to fit, it has been well received and will doubtless prove a useful window for scientists to look through, at the world in which we live.

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Paper milk bottles are being tried out in some parts of New York City.

To keep young salmon from "detouring" and being lost in irrigation canals and diversion ditches an engineer has devised a way of creating an electrified zone of water, which acts as an effective stop sign for the fish and turns them back to the main route.

Spring Constellations Now in Sky

Astronomy

By James Stokley

Spring has come, and astronomically we are made aware of that fact by the presence in the eastern evening sky of the kite-shaped constellation of Bootes, the Bear Driver, with the brillliant, creamy-white Arcturus; while towards the south, in the constellation of Virgo, the Virgin, shines another first magnitude star, Spica.

Arcturus is of special interest to astronomers because of its large "proper motion," which is the name given to the movement of a star across the heavens. To most of us the stars, and their groupings in the constellations, are symbolic of unalterable permanency, an idea which has been employed by the Mormons in Salt Lake City, who have placed the figure of the Great Dipper on the west wall of their Temple.

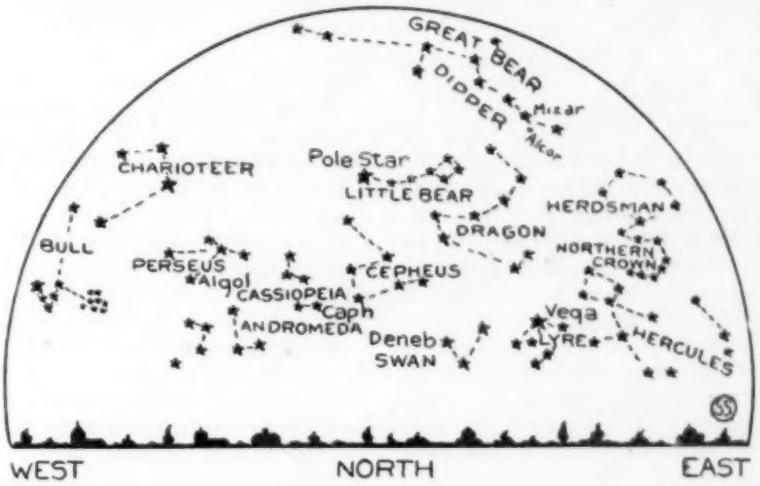
However, the stars are actually moving in the sky with varying speeds; most of them, it is true, so slowly that in a lifetime the keenest observer could not detect any change with the unaided eye, but in a few thousand years the Dipper, Orion, and other familiar star groups will no longer have the shape we see them in at present. Likewise, if present man had been on earth 20,000 years ago, in the time of the Cro-Magnon race, the constellations would have looked strangely distorted.

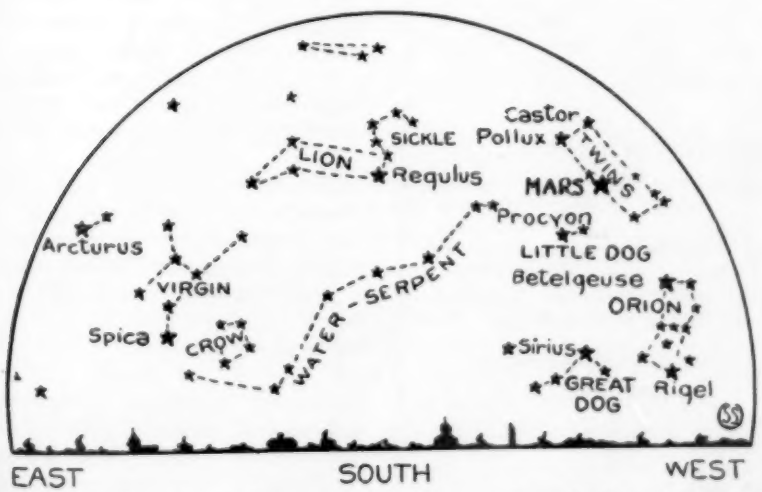
Astronomers measure this proper motion by the apparent distance that a star will travel in a year, using a second of arc for their unit. An idea of the size of a second may be gained from the fact that the moon's disc is about half a degree, or thirty minutes, or 1800 seconds, of arc in diameter. Of the stars whose proper motions have been measured, only about two hundred are known that move more than one second in a year, and as Arcturus travels about two and a quarter seconds annually, it is really a "runaway star." The star with the fastest known motion is too faint to be seen with the unaided eye. It was discovered by the late Prof. Barnard, of the Yerkes Observatory, and travels at the enormous speed of more than ten seconds a year.

Since the stars are so far away from the earth, the actual motion of such a body as Arcturus compared to the sun, for example, is enormous, in this case something like ninety miles a second, if one of the best estimates of its distance is used. Arcturus is also an exceedingly brilliant star, for if we were as far from it as we are from the sun, it would look 130 times as bright.

The other bright star in the eastern sky, Spica, or alpha Virginis, as the astronomers call it, is also an interesting orb. Though to the naked eye, and even with man's most powerful telescopes, it seems to be a single body, astronomers know that it is really double. The bright star that is seen is accompanied by a dark and invisible attendant about 12,000,000 miles from the bright body. Every four days they revolve around each other and together they weigh more than 15 times as much as the sun. The amount of light that they give out is more than 4,000 times as much as the sun and they are so far away from us that this light, though travelling fast enough to encircle the earth seven times in a second, takes more than three hundred years to reach us.

All these facts about this heavenly couple, half of which is invisible, have been learned through the fact that the light from the bright member of the pair carries its message to earth. When the light from a star is analyzed with the spectroscope, the astronomer can tell not only what it is made of, but also a great deal about its motion. The dark and bright lines which appear in the spectrum photograph carry this message in their position, for if a star is moving from the earth the lines are displaced in one direction, and if the star is approaching the earth they are (*Turn to next page*)





THESE MAPS show the evening stars as they appear these April evenings. Hold them in front of you and face north or south and the upper or lower is a picture of the sky in front of you

April Star Story—*Continued*

shifted to the other. These lines in the spectrum of Spica move back and forth, because, as the bright and dark members of the pair rotate around each other, the bright one is at one time approaching us, while at another it is receding. Thus the presence of the invisible body and the time of the rotation is made evident.

The ancients considered astronomy largely as astrology, a pseudo-science that has now been thoroughly discredited, for we know that the stars have no occult influence on our daily lives, as was formerly supposed. But as a result of these old ideas the constellations through which the sun passes were associated with the time of the year when it was in them. The sun, moon and planets move along a path called the zodiac, which is a belt traversing the sky along an imaginary line called the ecliptic. Constellations in this belt are called zodiacal constellations and the ancient astrologers represented them by what are known as the signs of the zodiac.

The sun enters Virgo in August, and so the constellation was associated with the harvest time. This is shown by the ancient star maps, for there she is represented as a woman with wings, walking, and carrying some heads of wheat, or sometimes ears of corn. According to the ancient poets, she represented Astraea, the goddess of justice; the constellation of Libra, the scales, nearby, being the balance in which she weighed the good and evil deeds of men.

Mars is the only planet left in the sky all evening. Venus, which was so brilliant a few months ago, is now close to the sun. On April 20, it is directly between the sun and the earth, and within a few weeks after that it will reappear in the early morning sky before sunrise. Jupiter is also approaching close to the sun, though in the early part of the month it can be seen in the western twilight, setting about two hours after the sun. Saturn can be seen in the eastern morning sky, rising about midnight.

Ten first magnitude stars are now visible. Low in the southwest is Sirius, in the great dog. Above it is Procyon, in the little dog. Low in the west is Aldebaran, in Taurus, the bull, while above it and to the north is Capella, in Auriga, the charioteer. South of Aldebaran is Betelgeuse, in Orion, while above it is Pollux one of the twins. Regulus, in Leo, the lion, is high in the south. Low in the northeast, just rising, is Vega, in Lyra the lyre. Arcturus, in Boo.es, is high in the east, and, with Spica, in Virgo, completes the list.

Science News-Letter, April 6, 1929

Critique of Behaviorism

Psychology

LEE WILSON DODD, in *The Great Enlightenment* (Harper's):

Rats in a maze are Watson's data. That's
Why Watson in a Maze observing rats
Strikes me as mildly comic. Not that he
Confesses to bewilderment like me,
Tho' we are tropped in the same Mystery!
No, Watson solves all mysteries with ease,
And in the face of God's infinities
Finds Life—*a Reflex sniffing round for Cheese.*
To which there is but one reply, and that's—
RATS. . . .

Science News-Letter, April 6, 1929

Do You Know That

A peculiar kind of Chinese fish is a carp which has eyes set slantwise and low in the head, so that the fish can watch for danger from below while feeding at the surface of the water with its upturned mouth.

A recent report states that Russian institutions for the mentally diseased can care for only 21,000 cases, whereas the public health authorities estimate that there are five times that number in need of hospital treatment.

The commercial air transportation companies of most European countries belong to the International Air Traffic Association, which publishes a joint time table and makes arrangements for rapid and smooth-working exchange of traffic.

Patients suffering from nervous and mental diseases spend about 50 per cent more time fidgeting during their night's rest than normal people do, according to an investigation under the auspices of the Mellon Institute of Industrial Research.

Writing of Ancient India Stirs Scholars

Archæology

By R. V. D. Magoffin

When Sir John Marshall, Director of Antiquities of India, published his discoveries at Mohenjo-daro in the Larkana district of northern Sind, and at Harappa in the southern Punjab, India at once took place alongside Mesopotamia, Egypt, and Crete as a fourth civilization, the remains of which could be dated earlier than 3500 B. C.

The spindle whorls found showed that the early inhabitants of these Indian towns understood how to spin and work in wool. Many tools and weapons of copper were also found. Statues and intaglios at Mohenjo-daro showed that the men wore a short garment like an apron with a strap over the left shoulder; at Harappa, 450 miles south, the men were nude. At both places the men wore sidewhiskers and beard, but no moustaches. They had oxen, buffalos, sheep, pigs, dogs, and horses; they raised wheat; they knew gold, silver, copper, tin, and lead. Of the greatest interest, however, is the fact that they could write. Inscribed seals were discovered in almost every house.

The first anouncement of these finds by Sir John Marshall in 1924 brought in their wake immediate reactions. Sayce saw likenesses between the art and script on the India seals and those from lower Mesopotamia. Other scholars began to compare them with the script of ancient Sumer. Dr. Barton of Philadelphia, the well known Mesopotamian savant, has entered the lists on the opposing side. There are a very few of the seals with script which might be identified with Sumerian, says Dr. Barton, but a few remind him rather of the so-called Hittite hieroglyphics. A Chinese student, having said that some of the script resembled old Chinese, brought about a study not only of Chinese, but also comparison with Egyptian, Cretan, Elamitic and Cypriste characters as well.

It is not possible as yet to compare all the inscribed seals, for not over one-third of them have as yet been published. Sir John Marshall's three volumes on the subject are being therefore eagerly awaited. On the evidence thus far, Dr. Barton avers that the Indian script of this time shows a long period of previous development, because of the conventionalization, and also that it was original and independent of the other script languages brought under comparison.

The original numerical system of the Sumerians was sexigecimal, but that at Mohenjo-daro and Harappa seems to be decimal. If that is proved, it would be an additional argument for the independence of the early peoples in India from the people of Sumer. The script can not be read, as yet, so it cannot be determined whether the Indian seal-script runs from left to right, right to left, or both ways, alternately. In the meantime, a mighty commotion is going on among the experts in eastern languages.

Science News-Letter, April 6, 1929

Stone Age Descendants in Africa

Archæology

Direct descendants of men of the Old Stone Age, eagerly sought for all over the world by anthropologists, are to be found in a small and dwindling race of South African natives, the Korannas. This is the opinion of Dr. Robert Broom, of Victoria College, Stellenbosch, S. A., reported to the British scientific journal, *Nature*.

The skull measurements of the present-day Korannas agree closely with those of a prehistoric skull recently found about 80 miles north of Pretoria, associated with the bones of an extinct species of buffalo, which had apparently killed the hunter and then died of its own wounds. The human skeleton was badly broken, the skull especially being crushed into small fragments. The latter, however, have been skillfully pieced together, permitting a scientific determination of the type of man it once belonged to.

The skull, which Dr. Broom has christened the "Bushveldt skull," is of modern type, with little or no suggestion of the Neandertal about it. It is not of the well-known European Cro-Magnon type, although Bushveldt man was contemporary with early Cro-Magnon man in Europe, as shown by the type of implements he used, and by the bones of the extinct buffalo. Its comparatively modern pattern is suggested, among other things, by its small teeth, its well-developed chin, and the relative thinness of its bony walls.

The character that marks Bushveldt man as a primitive type, and at the same time ties him up with the present Koranna tribe, is the relatively low temporal, or side region of the head. In all advanced races this part of the cranium is quite definitely high.

Although the Bushveldt skeleton was the first find of actual human remains to be made in the region, Dr. Broom is of the opinion that the valley of the Vaal river was once the home of tens if not hundreds of thousands of men and women of this race. He bases this conclusion on the enormous numbers of the stone implements of their workmanship which have been discovered.

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Chimborazo, a volcanic peak in Ecuador, rises almost 21,000 feet above sea level.

First False Teeth

Archæology

The first false teeth, so far as we know today, were worn by a woman of Sidon in Phoenicia about 300 B. C., according to Dr. Roy L. Moodie, anatomist of Santa Monica, Calif.

The Phoenician woman's jaw, with the false teeth, is now preserved in the Louvre in Paris. The two right incisors are represented by artificial teeth, held in place and bound to each other by gold wire. The wire has been drawn through careful perforations in the artificial teeth.

Although the Egyptian pioneered in treatment of many diseased conditions of the body, this sort of dental replacement apparently was never devised by Egyptian physicians. Thousands of mummies, representing seven thousand years of life in Egypt, have been examined, but no clear evidence of such repair work has ever been found. It appears that we not only owe our alphabet and numerous geographic discoveries to the restless, inquiring minds of the Phoenicians, Dr. Moodie points out, but also we are indebted to them for this entrance into prosthetics, which is a particularly valuable field of dentistry.

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An emerald the size of a man's fist is one of the items in the Turkish crown jewel collection.

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First Glances at New Books

OUR FACE FROM FISH TO MAN—W. K. Gregory—*Putnam* ($4.50). A brilliant popular exposition of the evolution of the human countenance, by one of the best-known of American paleontologists. The history of each feature, each bone, is traced, as well as the story of the face as a whole; and as the story grows one sits amazed at the beauty of the anatomical counter-point that has been written into the physiognomic symphony of even the plainest-featured among us.

Evolution
Science News-Letter, April 6, 1929

ESTADO ACTUAL DE LOS PRINCIPALES EDIFICIOS ARQUEOLOGICOS DE MEXICO — Secretaria de Education Publica—*Talleres Graficos de la Nacion.* A valuable summary of the present state of excavation and general knowledge concerning about thirty of Mexico's archæological sites. The chapters are by various well-known Mexican archæologists, and the illustrations are numerous and well chosen. A splendid map of several hundred sites where antiquities are known is a useful feature of the publication.

Archæology
Science News-Letter, April 6, 1929

EN LOS CONFINES DE LA SELVA LACANDONA—Enrique Juan Palacios—*Talleres Graficos de la Nacion.* Report of explorations by Mexican scientists, in 1926, in a jungle area of Mexico, where cities of the Old Maya Empire once stood. The expedition was particularly concerned with agricultural problems, such as the locust plagues that swarm over Mexican farm lands, but in this publication by a government archæologist emphasis is placed on the archæological discoveries, which were of exceptional importance and interest. The discovery of the ruined Maya city known as Santa Elena is described. Encounters with the little-known Lacandon Indians were another outstanding feature of the expedition.

Exploration—Archæology
Science News-Letter, April 6, 1929

INTRODUCTORY THEORETICAL CHEMISTRY—G. H. Cartledge—*Ginn* ($3.60). A concise text presenting the nub of a difficult subject. This will be a good book for the advanced student in chemistry who has begun to become a trifle bewildered; it will get his compass straight again.

Chemistry
Science News-Letter, April 6, 1929

THE "SOUL" OF THE PRIMITIVE—Lucien Levy-Bruhl—*Macmillan* ($5). The theme is primitive man's beliefs about life, death, and his own relation to the world. Since man in such a stage of development is not given to rationalizing nor to introspection, the task of reproducing his point of view is difficult, but when handled by this French philosopher the result is thought-provoking and reasonably convincing. It is generally considered that civilized man has come to look upon himself as an individual sharply silhouetted against the world, whereas in earlier stages of progress men feel themselves closer akin to their surroundings and to the social group. This difference is carried into many ramifications by the philosopher with illustrations taken from tribes all over the world. The translation is by Lilian A. Clare.

Ethnology—Philosophy
Science News-Letter, April 6, 1929

THE EARLIER INHABITANTS OF LONDON—F. G. Parsons—*Cecil Palmer, London* (10s 6d). The story of the people of London, strictly speaking, would begin about the time of the Roman conquest, but this author carries his account back to the Stone Age and the Bronze Age men and women who were the forerunners of the Londoners. The book ends with the period of the Danes. Since the subject of the early inhabitants of Britain is so blurred by controversy, many readers will welcome this organization of present knowledge by one of the well-known British anthropologists.

Anthropology
Science News-Letter, April 6, 1929

ANIMAL MYSTERIES—E. G. Boulenger—*Macauley* ($3). Queer animals of all kinds, both real and imaginary—echidnas, tapirs, St. Peter's fish, sea serpents—passed in review by a good naturalist who knows how to chat so that people will listen to him.

Natural History
Science News-Letter, April 6, 1929

WHO'S WHO AMONG THE MICROBES—W. H. Park and Anna W. Williams—*Century* ($3). An informal but comprehensive presentation of microbiology by two well-known public health workers. This book will be interesting to many a lay reader, and it can also be used to good advantage as a supplementary text in elementary bacteriology courses.

Microbiology
Science News-Letter, April 6, 1929

NATURE RAMBLINGS

By FRANK THONE

Natural History

Beaver Ways

Up in the North Woods, where there are still sheets of ice floating on their ponds, the beavers are beginning to come out of their dome-shaped houses of sticks to take a look about. They won't stay abroad, very much, until it gets a little warmer, and the new shoots of willow and poplar and alder around the pond margins are green and inviting; but they have been caged up all winter, with only stored twigs to gnaw, and a chance to get a breath of fresh air and a swim, even in cold water, is most welcome.

Then, too, the dams need inspecting, especially if freshets have brought down any debris to lodge against them. As soon as it is warm enough to make good, workable mud for plastering purposes all hands will have to turn out for some busy nights of hydraulic engineering and timber-snagging. Repairs must be made not only on the big dam that confines the protecting pond, but on the smaller subsidiary dams below it as well. These latter are important, because they take some of the strain off the main structure by backing up against its base and thereby balancing the pressure.

In the days of the early settlements beavers were plentiful everywhere; the "Beaver Creek" found in almost every township testifies to their great number and wide distribution. But their valuable fur caused their virtual extermination, and they survive now only in the deep woods of sparsely settled regions. That they can "come back" if given sufficient protection is shown in some of our national parks, where hunting of all kinds is prohibited. Here beavers have become so abundant that they are almost an embarrassment.

Science News-Letter, April 6, 1929

Books —*Continued*

THE STEPPE AND THE SOWN—Harold Peake and Herbert John Fleure—*Yale University Press* ($2). The fifth volume of the series entitled "Corridors of Time," in which human progress is traced through its stages of development. This book deals with the cultures of Europe and Asia from 2600 B. C. to 2100 B. C., at the time when the Stone Age was giving way to the age of metal. Emphasis is laid on migrations and trading activities which were becoming of increasing importance in the spread of knowledge and the scattering of racial types.

Anthropology—Archæology
Science News-Letter, April 6, 1929

THE ARUNTA (two volumes)—Baldwin Spencer and F. J. Gillen—*Macmillan, London* ($14.50). To write two such comprehensive volumes on a group of Australian natives these two authors became initiated members of the tribe and studied the people for many years. As nearly as modern civilized men may they caught the spirit of the Age of Stone, with its old mental outlook and its strange ways of life. Primitive men, untouched by the influence of civilization, are becoming difficult to find, and such a study as this is of great usefulness in making clearer the course of development of human stock. The chapters cover every important angle of primitive life: spirit beliefs, medicine practices, totems, initiation ceremonies, social organization, clothing and ornament, weapons and implements, sign language, myths and traditions, and so on. There are several hundred illustrations.

Ethnology
Science News-Letter, April 6, 1929

THE MOSQUITOES OF THE AMERICAS — Harrison G. Dyar — *Carnegie Inst. Publ.* 387 ($5 pa., $6 cl.). Entomologists interested in the Diptera, as well as public health men and others to whom mosquitoes are matters of practical concern, have been waiting with great expectation for this monograph. It is not the kind of a book that needs to be advertised; its market was "sold" in advance of its writing. Dr. Dyar has done the kind of a job that students of insects expected of him. His clear-cut determinations and full synopses will make the task of the mosquito worker easier for a generation or more to come.

Entomology
Science News-Letter, April 6, 1929

CLASSICS OF SCIENCE: Malthus on Population

Biology—Economics

This is the first chapter of the essay which started Darwin on the train of thought that led to his theory of Natural Selection, immortalized by Huxley as the Survival of the Fittest.

An essay on the PRINCIPLE OF POPULATION; or, A View of its Past and Present Effects on Human Happiness; with an inquiry into our prospects respecting the future removal or mitigation of the evils which it occasions. A new edition, very much enlarged. By T. R. Malthus, A. M., Fellow of Jesus College, Cambridge. London: 1803.

Statement of the Subject

In an inquiry concerning the future improvement of society, the mode of conducting the subject which naturally presents itself is:

1. An investigation of the causes that have hitherto impeded the progress of mankind towards happiness; and

2. An examination into the probability of the total or partial removal of these causes in future.

To enter fully into this question, and to enumerate all the causes that have hitherto influenced human improvement, would be much beyond the power of an individual. The principal object of the present essay is to examine the effects of one great cause intimately united with the very nature of man, which, though it has been constantly and powerfully operating since the commencement of society, has been little noticed by the writers who have treated this subject. The facts which establish the existence of this cause have, indeed, been repeatedly stated and acknowledged, but its natural and necessary effects have been almost totally overlooked; though probably among these effects may be reckoned a very considerable portion of that vice and misery, and of that unequal distribution of the bounties of nature, which it has been the unceasing object of the enlightened philanthropist in all ages to correct.

The cause to which I allude is the constant tendency in all animated life to increase beyond the nourishment prepared for it.

It is observed by Dr. Franklin that there is no bound to the prolific nature of plants or animals but what is made by their crowding and interfering with each other's means of subsistence. Were the face of the earth, he says, vacant of other plants, it might be gradually sowed and overspread with one kind only; as, for instance, with fennel: and were it empty of other inhabitants, it might in a few ages be replenished from one nation only; as, for instance, with Englishmen.

T. R. MALTHUS
At Haileybury College

This is incontrovertibly true. Through the animal and vegetable kingdoms Nature has scattered the seeds of life abroad with the most profuse and liberal hand; but has been comparatively sparing in the room and nourishment necessary to rear them. The germs of existence contained in this spot of earth, with ample food, and ample room to expand in, would fill millions of worlds in the course of a few thousand years. Necessity, that imperious all-pervading law of nature, restrains them within prescribed bounds. The race of plants and the race of animals shrink under this great restrictive law; and the race of man cannot by any efforts of reason escape from it.

In plants and animals the view of the subject is simple. They are all impelled by a powerful instinct to the increase of their species; and this instinct is interrupted by no reasoning or doubts about providing for their offspring. Wherever, therefore, there is liberty, the power of increase is exerted; and the superabundant effects are repressed afterwards by want of room and nourishment, which is common to plants and animals; and among animals, by their becoming the prey of each other.

The effects of this check on man are more complicated. Impelled to the increase of his species by an equally powerful instinct, reason interrupts his career, and asks him whether he may not bring beings into the world for whom he cannot provide the means of support. If he attend to this natural suggestion, the restriction too frequently produces vice. If he hear it not, the human race will be constantly endeavoring to increase beyond the means of subsistence. But as by that law of nature which makes food necessary to the life of man, population can never actually increase beyond the lowest nourishment capable of supporting it; a strong check on population, from the difficulty of acquiring food, must be constantly in operation. This difficulty must fall somewhere; and must necessarily be severely felt in some or other of the various forms of misery, or the fear of misery, by a large portion of mankind. . . .

Increase of Population and Food

Whether the law of marriage be instituted or not, the dictate of nature and virtue seems to be an early attachment to one woman; and where there were no impediments of any kind in the way of an union to which such an attachment would lead, and no causes of depopulation afterwards, the increase of the human species would be evidently much greater than any increase which has been hitherto known.

In the Northern States of America, where the means of subsistence have been more ample, the manners of the people more pure, and the checks to early marriages fewer than in any of the modern states of Europe, the population was found to double itself for some successive periods every twenty-five years. Yet even during these periods, in some of the towns, the deaths exceeded the births; and they consequently required a continued supply from the country to support their population.

In the back settlements, where the sole employment was agriculture, and vicious customs and unwholesome occupations were unknown, the population was found to double itself in fifteen years. Even this extraordinary rate of increase is probably short of the utmost power of population. Very severe labour is requisite to clear a fresh country; such situations are not in general considered as particularly healthy; and the (*Turn to next page*)

Malthus on Population—*Continued*

inhabitants were probably occasionally subject to the incursions of the Indians, which might destroy some lives, or at any rate diminish the fruits of their industry.

According to a table of Euler, calculated on a mortality of 1 in 36, if the births be to the deaths in the proportion of 3 to 1, the period of doubling will be only 12 4-5 years. And these proportions are not only possible suppositions, but have actually occurred for short periods in more countries than one.

Sir William Petty supposes a doubling possible in so short a time as ten years.

But to be perfectly sure that we are far within the truth, we will take the slowest of these rates of increase; a rate in which all concurring testimonies agree, and which has been repeatedly ascertained to be from procreation only.

It may safely be pronounced, therefore, that population when unchecked goes on doubling itself every twenty-five years, or increases in a geometrical ratio.

The rate according to which the productions of the earth may be supposed to increase, it will not be so easy to determine. Of this, however, we may be perfectly certain, that the ratio of their increase must be totally of a different nature from the ratio of the increase of population. A thousand millions are just as easily doubled every twenty-five years by the power of population as a thousand. But the food to support the increase from the greater number will by no means be obtained with the same facility. Man is necessarily confined in room. When acre has been added to acre till all the fertile land is occupied the yearly increase of food must depend upon the amelioration of the land already in possession. This is a stream, which, from the nature of all soils, instead of increasing, must be gradually diminished. But population, could it be supplied with food, would go on with unexhausted vigour; and the increase of one period would furnish the power of a greater increase the next, and this, without any limit.

. . .

Europe is by no means so fully peopled as it might be. In Europe there is the fairest chance that human industry may receive its best direction. The science of agriculture has been much studied in England and Scotland; and there is still a great portion of uncultivated land in these countries. Let us consider, at what rate the produce of this island might be supposed to increase under circumstances the most favorable to improvement.

If it be allowed, that by the best possible policy, and great encouragements to agriculture, the average produce of the island could be doubled in the first twenty-five years, it will be allowing probably a greater increase than could with reason be expected.

In the next twenty-five years it is impossible to suppose that the produce could be quadrupled. It would be contrary to all our knowledge of the properties of land. The improvement of the barren parts would be a work of time and labour; and it must be evident to those who have the slightest acquaintance with agricultural subjects, that in proportion as cultivation extended, the additions that could yearly be made to the former average produce, must be gradually and regularly diminishing. That we may be the better able to compare the increase of population and food, let us make a supposition, which, without pretending to accuracy, is clearly more favourable to the power of production in the earth than any experience that we have had of its qualities will warrant.

Let us suppose that the yearly additions which might be made to the former average produce, instead of decreasing, which they certainly would do, were to remain the same; and that the produce of this island might be increased every twenty-five years by a quantity equal to what it at present produces: the most enthusiastic speculator cannot suppose a greater increase than this. In a few centuries it would make every acre of land in the island like a garden.

If this supposition be applied to the whole earth, and if it be allowed that the subsistence for man which the earth affords, might be increased every twenty-five years by a quantity equal to what it at present produces, this will be supposing a rate of increase much greater than we can imagine that any possible exertions of mankind could make it.

It may be fairly pronounced, therefore, that, considering the present average state of the earth, the means of subsistence, under circumstances the most favourable to human industry, could not possibly be made to increase faster than in an arithmetical ratio.

The necessary effects of these two different rates of increase, when brought together, will be very striking. Let us call the population of this island eleven millions; and suppose the present produce equal to the easy support of such a number. In the first twenty-five years the population would be twenty-two millions, and the food being also doubled, the means of subsistence would be equal to this increase. In the next twenty-five years, the population would be forty-four millions, and the means of subsistence only equal to the support of thirty-three millions. In the next period would be eighty-eight millions, and the means of subsistence just equal to the support of half that number. And at the conclusion of the first century, the population would be a hundred and seventy-six millions, and the means of subsistence only equal to the support of fifty-five millions; leaving a population of a hundred and twenty-one millions totally unprovided for.

Taking the whole earth instead of this island, emigration would of course be excluded and supposing the present population equal to a thousand millions, the human species would increase as the numbers 1, 2, 4, 8, 16, 32, 64, 128, 256, and subsistence as 1, 2, 3, 4, 5, 6, 7, 8, 9. In two centuries the population would be to the means of subsistence as 256 to 9; in three centuries as 4096 to 13, and in two thousand years the difference would be almost incalculable.

In this supposition no limits whatever are placed to the produce of the earth. It may increase for ever, and be greater than any assignable quantity; yet still the power of population being in every period so much superior, the increase of the human species can only be kept down to the level of the means of subsistence by the constant operation of the strong law of necessity acting as a check upon the greater power.

Thomas Robert Malthus (1766-1834) at the age of 32 had an argument with his father on the subject of Condorcet's and Godwin's plans for making everybody happy, and convinced him that such a course is impossible. The father was so impressed with his son's arguments that he asked him to write them down. So appeared the first edition of the Essay on Population. Malthus went abroad to study economic conditions in other countries. The findings were incorporated in a new form of the Essay, published in 1803, from which the "Classic" above was taken. Malthus was professor of modern history and political economy in Haileybury College from 1805 until his sudden death from heart disease at the age of 69.